

June 2, 1998
File 0072-03-10

201a
Feddelor 9/D
Lake. Co.

**FEDDELER C/D LANDFILL
NORTH FACILITY WEST CELL
CONSTRUCTION COMPLETION REPORT**

**R&M Enterprises, Inc.
Lowell, Indiana**

Permit/IND FP # 45-08

Spring 1998

Prepared For:
R&M Enterprises, Inc.
18501 Clark Road
Lowell, Indiana 46356

*Weaver
Boos
Consultants, Inc.*

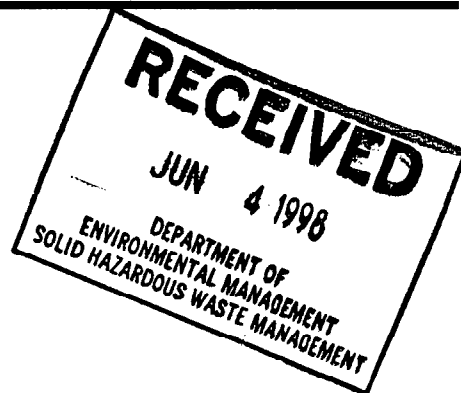
ENVIRONMENTAL AND GEOTECHNICAL SERVICES
Chicago, Illinois Griffith, Indiana Albuquerque, New Mexico

*Weaver
Boos
Consultants, Inc.*

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604 • 312/922-1030 FAX 922-0201

June 3, 1998
Project # 97094.02

Solid Waste Facilities Branch
Office of Solid and Hazardous Waste Management
Indiana Department of Environmental Management
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015



**Re: Feddeler C/D Landfill North Facility
Construction Completion Report for
Construction of West Cell**

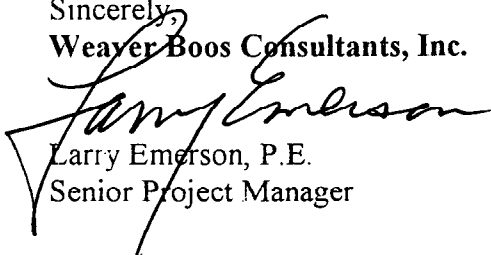
Dear Sirs:

In accordance with the approved Permit # 45-08, we are sending herewith two copies of the above referenced construction completion report. Enclosed please find documentation of procedures applied to the construction of the West Cell.

I hereby certify that to the best of my knowledge, the North Facility West Cell has been constructed in accordance with the applicable permit documents and regulatory requirements. This certification is based upon construction oversight conducted by properly trained and experienced persons working under my direct supervision.

If you have any questions or require additional information, please call me.

Sincerely,
Weaver Boos Consultants, Inc.


Larry Emerson, P.E.
Senior Project Manager

Enclosure
cc: Ms. Julie Feddeler (R & M Enterprises)

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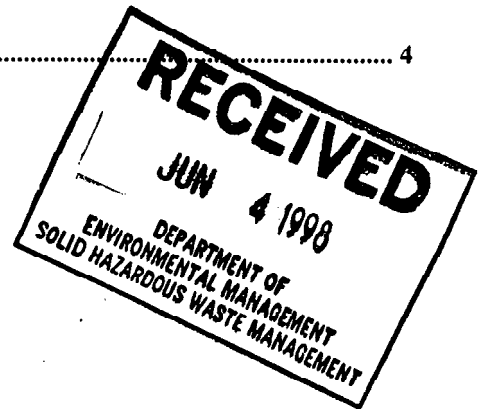
ENVIRONMENTAL AND GEOTECHNICAL SERVICES
Griffith, IN **Albuquerque, NM**

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1.0 INTRODUCTION

1.1 General

This report assembles the Construction Testing performed during the construction of the West Cell at the Feddler C/D Landfill. All work was performed in general accordance with the conditions of permit FP# 45-08 issued on August 7, 1981 and modified on June 13, 1995.

A minimum 3-foot thick in-situ clay barrier was undisturbed during the construction of the West Cell located at the north end of the facility. Per permit requirements (Part A1), in-situ clay material shall consist of clayey soils with a hydraulic conductivity value of 1×10^{-6} cm/sec or less. The project area was surveyed and benchmarks were established so that locations of sample points could be readily discernible and used as control points to verify the minimum 3.0 feet of in-situ clay material remained undisturbed.

Daily reports documenting various field activities performed during the course of the project are included in **Appendix A**.

2.0 IN-SITU BARRIER VERIFICATION

2.1 General

At the West Cell of the North Facility Feddeler C/D Landfill in-situ clay material was undisturbed to provide a minimum 3.0 foot thick clay barrier between the bottom of waste and top of sand layer. In-situ clay material consisted of clayey soil that possessed a hydraulic conductivity value of 1×10^{-6} cm/sec or less meeting requirements of the permit, Part A4 and A1, respectively.

2.2 Cell Verification

Prior to the West Cell construction, Weaver Boos established survey benchmarks to be used as control points during excavation of the West Cell. These control points were placed to assure that a minimum 3 feet of in-situ clay barrier remained in-place and undisturbed between the top of sand layer and the bottom of waste elevation. To assess depth of cell excavation, Weaver Boos referenced a cross-section developed by Cole Associates. The cross-section was based on boring logs from the installation of monitoring wells MW-1 and MW-6. The borings were performed by Cole Associates on May 7 and May 16, 1996, respectively. Boring logs of MW-1 and MW-6 are presented in **Appendix B**. As shown in **Figure 1**, MW-1 is located north of the West Cell and MW-6 is located southwest of the West Cell. Based on the monitoring well locations, the cross-section transects the West Cell from the northeast to the southwest. According to the cross-section, the top of sand layer elevation dips from approximately 674 msl at MW-1 to approximately 667 msl at MW-6. A cross-section of MW-1 and MW-6 transecting the West Cell is shown as Figure 2 in the **Figure** Section. Surveying performed by Weaver Boos, upon completion of cell excavation, showed the cell floor to possess an average elevation of approximately 681 msl. Comparing the elevation of top of sand to bottom of waste on the cross-section, the in-situ clay barrier ranges in thickness from approximately seven feet near MW-1 to approximately 11 feet towards MW-6. Survey data appears in **Appendix D**.

Based on survey data, the West Cell met or exceeded the permit requirements (Part A1) of a minimum 3 foot thick barrier of in-situ clayey soil material is necessary between the top of sand layer and the bottom of waste elevation.

2.3 In-Situ Clay Material Quality Evaluation Testing

Weaver Boos collected undisturbed soil samples from the West Cell floor. Based on the permit requirements of one boring per five acres of disposal area only one Shelby tube was necessary

for verification of the 1.5 acre cell. **Figure 1** shows the perimeter of the West Cell. Soil samples were collected via Shelby tube method. Four Shelby tubes were advanced into the cell floor to an approximate three foot depth. Two of the four Shelby tubes were submitted for laboratory testing. Upon extracting the soil from the Shelby tubes, Weaver Boos observed that the collected soil sample consisted of a clayey soil. In accordance with the permit requirements, that the barrier layer possess a minimum hydraulic conductivity value of 1×10^{-6} cm/sec (PART A1), Weaver Boos performed laboratory soil tests on the extruded material.

Permeability testing was performed on two (2) undisturbed soil samples. Samples were isotropically consolidated and backpressure saturated before beginning the permeability testing. Preliminary results of soil collected in Shelby tubes from the West Cell possess hydraulic conductivity values ranging from 1.407×10^{-8} cm/sec to 2.770×10^{-8} cm/sec. Finalized hydraulic conductivity test results will be faxed to the Illinois Environmental Protection Agency upon their completion. Undisturbed permeability test results can be found in **Appendix C**.

Based on the approved permit, grain size analysis and USDA Classification were performed on collected in-situ material. Grain size analysis revealed that soil texture (USDA) from Shelby tube-1 (ST-1) was a Clay loam and Shelby tube-2 (ST-2) was a Sandy clay loam. Grain size test results can be found in **Appendix C**.

3.0 ENGINEERING CERTIFICATION

CONSTRUCTION COMPLETION REPORT

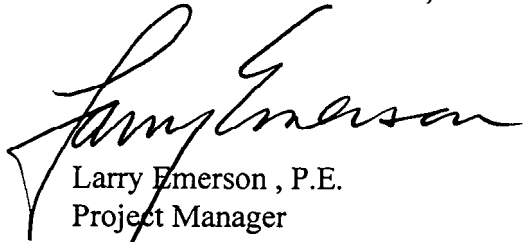
Feddeler North Facility C/D Landfill

West Cell

Lowell, Indiana

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information.

Very truly yours,
Weaver Boos Consultants, Inc.


Larry Emerson, P.E.
Project Manager
Indiana Registration #19825



Figures Section

Appendix A

Daily Field Reports

WEAVER BOOS CONSULTANTS, INC.

200 South Michigan Avenue, Chicago, IL 60604
Phone: (312) 922-1030 Fax: (312) 922-0201

213 S. Camino Del Pueblo, Bernalillo, NM 87114
Phone: (505) 890-0573 Fax (505) 890-0534

Daily Summary Report

Owner	Feddeler	Date	05-12-98	Day	Tuesday	Report No.:	1
Project	Feddeler C/D Landfill West Cell	Weather A.M.	Light Breeze	P.M.	Light Breeze	Page:	1 of 1
Project #	97094.02	Temp(°F)High	72	Low	64	Precipitation:	None

Contractor(s): Feddeler's Operators.
Contractor Sub(s): None

Summary of Daily Construction Progress and Inspections:

Weaver Boos Representative performed surveying work for the West Cell construction. Survey control benchmarks were established as reference points during the cell construction in order not to over excavate in-situ clay material. The control points were set on the perimeter of the cell.

Summary of Problems and Resolutions:

Summary of Meeting(s) Held and Attendees:

Discussions held with Bill Feddeler concerning methods to prevent ponding of water within the cell.

Personnel:

Peter Cambouris (WBC Rep.) Bill Feddeler Operations Manager, (Feddeler Landfill).

Equipment:

One Katmatsu 400 backhoe, one Volvo BM A30, one CAT D8 LGP Dozer.

Visitors:

None

Signature



Peter Cambouris
Technician

WEAVER BOOS CONSULTANTS, INC.

200 South Michigan Avenue, Chicago, IL 60604
Phone: (312) 922-1030 Fax: (312) 922-0201

213 S. Camino Del Pueblo, Bernalillo, NM 87114
Phone: (505) 890-0573 Fax (505) 890-0534

Daily Summary Report

Owner	Feddeler	Date	05-27-98	Day	Wednesday	Report No.:	2
Project	Feddeler C/D Landfill West Cell	Weather A.M.	Calm	P.M.	Calm	Page:	1 of 1
Project #	97094.02	Temp(°F)High	74	Low	69	Precipitation:	None

Contractor(s): Feddeler's Operators.
Contractor Sub(s): None

Summary of Daily Construction Progress and Inspections:

Weaver Boos Representative performed surveying work for the West Cell construction. Weaver Boos rep surveyed the perimeter and floor of the cell. Survey shots showed that over excavation did not occur and that there was a minimum of 3 feet of undisturbed in-situ clay material throughout the cell floor.

Summary of Problems and Resolutions:

Summary of Meeting(s) Held and Attendees:

Personnel:

Peter Cambouris (WBC Rep.) Bill Feddeler Operations Manager, (Feddeler C/D Landfill).

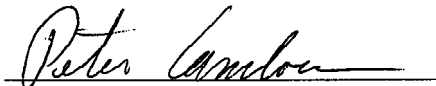
Equipment:

One Katmatsu 400 backhoe, one Volvo BM A30, one CAT D8 LGP Dozer,.

Visitors:

None

Signature


Peter Cambouris
Technician

Appendix B

Boring Logs

BORING LOG: MW-1

PAGE 1 OF 4

PROJECT NAME: Feddeler Landfill
 PROJECT NUMBER: 9563-0030-70
 LOCATION: **R & M Enterprises**
 18501 Clark Road,
 Lowell, Lake County, Indiana

DATE: 5/7/96
 LOGGED BY: John E. Greene (Cole Assoc.)
 WEATHER: Cloudy, 40-60°

DRILLING COMPANY: Top Flight
 DRILLER: Jeff Copak
 RIG TYPE: Mobile B-61
 DRILLING METHOD: Hollow Stem Auger
 BOREHOLE DIAMETER: 6 1/4"
 GROUND ELEVATION: 699.7'
 DEPTH TO WATER: 19.3'

TOTAL DEPTH: 82'
 WELL DIAMETER: 2" (PVC Riser & Screen)
 TOC ELEVATION: 702.80' Above MSL
 SCREENED INTERVAL: 27-32' (0.01" Slot)
 FILTER PACK INTERVAL: 25-32'
 BENTONITE INTERVAL: 22-25'
 GROUT INTERVAL: 1-22'

SAMPLE DATA						DESCRIPTION OF LITHOLOGY			GRAPHIC DIAGRAMS		
SAMPLE TYPE & NUMBER	SAMPLE DEPTH INTERVAL (FEET)	BLOW COUNTS	RECOVERY	PID (PPM)	OTHER SAMPLE DATA REMARKS (Munsell Color)	DEPTH (FEET)	DESCRIBE THE FOLLOWING: COLOR, GRAIN SIZE, MAJOR & MINOR CONSTITUENTS, STRUCTURES, RELATIVE DENSITY, CONSISTENCY, MOISTURE CONTENT	USCS SYMBOL	SAMPLE INTERVAL	LITHOLOGIC PROFILE	WELL CONSTRUCTION DIAGRAM
S-1	0-2	6/8	1.4'				Topsoil, Moist.				
		10/9					Orange-Brown with a Few Gray Mottles Silty CLAY, Trace Sand, Trace Gravel, Stiff to Very Stiff, Moist.	CL			
S-2	2-4	9/14	1.7'								
		15/3			(10YR 4/3-4)						
S-3	4-6	5/8	1.5'			5			5		
		12/15									
S-4	6-8	9/13	1.5'								
		18/20									
S-5	8-10	6/12	1.9'								
		16/19				10			10		
S-6	10-12	7/12	1.8'				-Charcoal Fragments				
		13/15									
S-7	12-14	5/11	1.7'				-Little Gravel				
		15/18									
S-8	14-16	5/6	1.5'			15			15		
		7/13					Brown Silty SAND, Trc. Gravel, Trc. Clay, Saturated.	SM			
							Brown, Few Gray Mottles Silty CLAY, Moist.	CL			
S-9	16-18	4/6	1.2'				Gray Silty CLAY, Trace Sand, Trace Gravel, Stiff, Moist.	CL			
		7/13									
S-10	18-20	4/5	1.8'		(2.5Y 3/2)						
		8/8				20			20		
S-11	20-22	4/5	1.7'								
		5/8									
S-12	22-24	4/5	1.7'								
		8/11									
S-13	24-26	2/4	1.8'			25			25		
		2/7			(2.5Y 5-4/2)		Grayish Brn. Fine to Medium SAND, Trace Coarse Sand, Trc. Silt, Loose, Sat	SP			
							Boring Continued on Page 2.				

COMMENTS:

SAMPLE INTERVAL

 = Split Spoon Soil Sample

BORING LOG: MW-1

PAGE 2 OF 4

PROJECT NAME: Feddeler Landfill
 PROJECT NUMBER: 9563-0030-70
 LOCATION: R & M Enterprises
 18501 Clark Road,
 Lowell, Lake County, Indiana
 DATE: 5/7/96
 LOGGED BY: John E. Greene (Cole Assoc.)
 WEATHER: Cloudy, 40-60°

DRILLING COMPANY: Top Flight
 DRILLER: Jeff Copak
 RIG TYPE: Mobile B-61
 DRILLING METHOD: Hollow Stem Auger
 BOREHOLE DIAMETER: 6 1/4"
 GROUND ELEVATION: 699.7'
 DEPTH TO WATER: 19.3'

TOTAL DEPTH: 82'
 WELL DIAMETER: 2" (PVC Riser & Screen)
 TOC ELEVATION: 702.80' Above MSL
 SCREENED INTERVAL: 27-32' (0.01" Slot)
 FILTER PACK INTERVAL: 25-32'
 BENTONITE INTERVAL: 22-25'
 GROUT INTERVAL: 1-22'

SAMPLE DATA						DESCRIPTION OF LITHOLOGY			GRAPHIC DIAGRAMS			
SAMPLE TYPE & NUMBER	SAMPLE DEPTH INTERVAL (FEET)	BLOW COUNTS	RECOVERY	PID (PPM)	OTHER SAMPLE DATA REMARKS (Munsell Color)	DEPTH (FEET)	DESCRIBE THE FOLLOWING: COLOR, GRAIN SIZE, MAJOR & MINOR CONSTITUENTS, STRUCTURES, RELATIVE DENSITY, CONSISTENCY, MOISTURE CONTENT	USCS SYMBOL	SAMPLE INTERVAL	LITHOLOGIC PROFILE	WELL CONSTRUCTION DIAGRAM	
							Grayish Brown Fine to Medium SAND, Trace Coarse Sand, Trace Gravel, Trace Silt, Loose to Medium Dense, Saturated.	SP				
S-14	26-28	2/2	1.8'		(2.5Y 5-4/2)							
		7/6										
S-15	28-30	8/11	2.0'									
		12/11				30						
S-16	30-32	2/3	0.9'									
		4/6										
S-17	32-34	6/8	2.0'									
		17/24										
S-18	34-36	4/10	1.8'			35						
		18/29										
S-19	36-38	9/11	2.0'									
		15/18										
S-20	38-40	6/9	1.8'				Gray Silty CLAY, Trace Sand and Gravel, Very Stiff, Moist	CL				
		11/17				40						
S-21	40-42	8/11	1.0'									
		17/18										
S-22	42-44	2/5	1.2'				Gray Fine to Coarse SAND, Trace Gravel, Loose to Medium Dense, Saturated.	SP				
		7/10										
S-23	44-46	17/23	2.0'			45	Gray Fine SAND, Trace Medium Sand, Loose, Saturated.	SP				
		28/30										
S-24	46-48	10/10	2.0'									
		16/13										
S-25	48-50	7/4	1.7'		(2.5Y 5-4/2)							
		6/10				50	Dark Gray Silty CLAY, Trace Sand, Very Stiff, Mst	CL				
							Boring Continued on Page 3.					

COMMENTS:

SAMPLE INTERVAL

 = Split Spoon Soil Sample


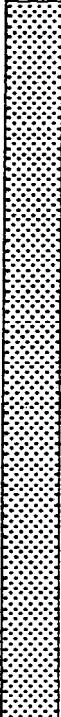



BORING LOG: MW-1

PAGE 3 OF 4

PROJECT NAME: Feddeler Landfill
 PROJECT NUMBER: 9563-0030-70
 LOCATION: R & M Enterprises
 18501 Clark Road,
 Lowell, Lake County, Indiana
 DATE: 5/7/96
 LOGGED BY: John E. Greene (Cole Assoc.)
 WEATHER: Intermittent Rain, 40-60°

DRILLING COMPANY: Top Flight
 DRILLER: Jeff Copak
 RIG TYPE: Mobile B-61
 DRILLING METHOD: Hollow Stem Auger
 BOREHOLE DIAMETER: 6 1/4"
 GROUND ELEVATION: 699.7'
 DEPTH TO WATER: 193'

TOTAL DEPTH: 82'
 WELL DIAMETER: 2" (PVC Riser & Screen)
 TOC ELEVATION: 702.80' Above MSL
 SCREENED INTERVAL: 27-32' (0.01" Slot)
 FILTER PACK INTERVAL: 25-32'
 BENTONITE INTERVAL: 22-25'
 GROUT INTERVAL: 1-22'

SAMPLE DATA						DESCRIPTION OF LITHOLOGY			GRAPHIC DIAGRAMS			
SAMPLE TYPE & NUMBER	SAMPLE DEPTH INTERVAL (FEET)	BLOW COUNTS	RECOVERY	PID (PPM)	OTHER SAMPLE DATA REMARKS	DEPTH (FEET)	DESCRIBE THE FOLLOWING: COLOR, GRAIN SIZE, MAJOR & MINOR CONSTITUENTS, STRUCTURES, RELATIVE DENSITY, CONSISTENCY, MOISTURE CONTENT	USCS SYMBOL	SAMPLE INTERVAL	LITHOLOGIC PROFILE	WELL CONSTRUCTION DIAGRAM	
S-26	50-52	10/8	1.7'				Gray Silty CLAY, Trace Sand, Very Stiff to Hard, Moist.	CL				
		13/14										
S-27	52-54	26/38	0.5'									
		50 for 4"					Light Brown Fine SAND, Trace Medium Sand, Trace Coarse Sand, Medium Dense to Dense, Saturated.	SP				
S-28	54-56	7/9	2.0'			55			55			
		10/17										
S-29	56-58	17/23	0.0'									
		26/36										
S-30	58-60	10/12	2.0'									
		26/18				60			60			
S-31	60-62	14/16	2.0'									
		20/21										
S-32	62-64	16/16	0.0'									
		23/31										
S-33	64-66	6/18	2.0'				Gray Silty CLAY, Trace Sand, Trace Gravel, Very Stiff, Moist.	CL				
		25/31				65			65			
S-34	66-68	15/16	1.5'									
		9/9										
S-35	68-70	7/8	1.2'									
		12/10				70			70			
S-36	70-72	1/8	0.0'				Grayish Brown Fine SAND, Trace medium to Coarse Sand, Medium Dense to Dense, Saturated.	SP				
		8/23										
S-37	72-74	7/8	2.0'									
		18/23										
S-38	74-76	6/10	0.0'									
		13/19				75			75			
						Boring Continued on Page 4.						

COMMENTS:

SAMPLE INTERVAL

 = Split Spoon Soil Sample

BORING LOG: MW-1

PAGE 4 OF 4

PROJECT NAME: Feddeler Landfill
 PROJECT NUMBER: 9563-0030-70
 LOCATION: R & M Enterprises
 18501 Clark Road,
 Lowell, Lake County, Indiana
 DATE: 5/7/96
 LOGGED BY: John E. Greene (Cole Assoc.)
 WEATHER: Cloudy, 40-60°

DRILLING COMPANY: Top Flight
 DRILLER: Jeff Copak
 RIG TYPE: Mobile B-61
 DRILLING METHOD: Hollow Stem Auger
 BOREHOLE DIAMETER: 6 1/4"
 GROUND ELEVATION: 699.7'
 DEPTH TO WATER: 19.3'

TOTAL DEPTH: 82'
 WELL DIAMETER: 2" (PVC Riser & Screen)
 TOC ELEVATION: 702.80' Above MSL
 SCREENED INTERVAL: 27-32' (0.01" Slot)
 FILTER PACK INTERVAL: 25-32'
 BENTONITE INTERVAL: 22-25'
 GROUT INTERVAL: 1-22'

SAMPLE DATA						DESCRIPTION OF LITHOLOGY			GRAPHIC DIAGRAMS		
SAMPLE TYPE & NUMBER	SAMPLE DEPTH INTERVAL (FEET)	BLOW COUNTS	RECOVERY	PID (PPM)	OTHER SAMPLE DATA REMARKS	DEPTH (FEET)	DESCRIBE THE FOLLOWING: COLOR, GRAIN SIZE, MAJOR & MINOR CONSTITUENTS, STRUCTURES, RELATIVE DENSITY, CONSISTENCY, MOISTURE CONTENT	USCS SYMBOL	SAMPLE INTERVAL	LITHOLOGIC PROFILE	WELL CONSTRUCTION DIAGRAM
S-39	76-78	6/10	1.5'				Grayish Brown Fine SAND, Trace Medium to Coarse Sand, Medium to Medium Dense, Saturated.	SP			
		13/19					Dark Gray Silty CLAY, Trace Sand and Gravel, Very Stiff to Hard, Moist.	CL			
S-40	78-80	12/18	1.7'								
		16/15				80					
S-41	80-82	8/11	2.0'								
		14/15									
							End of Boring at 82'.				
						85					
						90					
						95					
						100					

COMMENTS:

SAMPLE INTERVAL

 = Split Spoon Soil Sample

BORING LOG: MW-6

PAGE 1 OF 2

PROJECT NAME: Feddeler Landfill
 PROJECT NUMBER: 9563-0030-70
 LOCATION: R & M Enterprises
 18501 Clark Road,
 Lowell, Lake County, Indiana
 DATE: 5/16/96 (Boring) & 5/17/96 (Well)
 LOGGED BY: Steve J. Winters
 WEATHER: Sun, 50-70°

DRILLING COMPANY: Top Flight
 DRILLER: Jeff Copak
 RIG TYPE: Mobile B-61
 DRILLING METHOD: Hollow Stem Auger
 BOREHOLE DIAMETER: 6 1/4"
 GROUND ELEVATION: 693.1'
 DEPTH TO WATER: 12.8'

TOTAL DEPTH: 32'
 WELL DIAMETER: 2" (PVC Riser & Scribe)
 TOC ELEVATION: 695.97' Above MSL
 SCREENED INTERVAL: 26-31' (0.01" Slot)
 FILTER PACK INTERVAL: 24-31'
 BENTONITE INTERVAL: 20-24'
 GROUT INTERVAL: 1-20'

SAMPLE DATA						DESCRIPTION OF LITHOLOGY			GRAPHIC DIAGRAMS		
SAMPLE TYPE & NUMBER	SAMPLE DEPTH INTERVAL (FEET)	BLOW COUNTS	RECOVERY	PID (PPM)	OTHER SAMPLE DATA REMARKS (Munsell Color)	DEPTH (FEET)	DESCRIBE THE FOLLOWING: COLOR, GRAIN SIZE, MAJOR & MINOR CONSTITUENTS, STRUCTURES, RELATIVE DENSITY, CONSISTENCY, MOISTURE CONTENT	USCS SYMBOL	SAMPLE INTERVAL	LITHOLOGIC PROFILE	WELL CONSTRUCTION DIAGRAM
S-1	0-2	1/3	0.5'				Light Brown Silty CLAY, Trace Gravel, Soft to Medium Stiff, Moist.	CL			
		3/2									
S-2	2-4	3/7	1.5'		(10YR 4/3-4)		Brown with Gray Mottling Silty CLAY, Trace Gravel, Stiff to Very Stiff, Moist.	CL			
		11/14									
S-3	4-6	6/13	1.7'			5			5		
		18/16									
S-4	6-8	11/13	1.9'				Brown Silty CLAY, Trace to little Sand, Trace Gravel, Very Stiff to Hard, Moist.	CL			
		16/18									
S-5	8-10	11/13	2.0'								
		28/17				10			10		
S-6	10-12	13/21	1.0'		(2.5Y 3/2)		Gray Sandy, Silty CLAY, Trace Gravel, Occasional Shale Fragments, Hard, Moist.	CL			
		19/22					Brown Fine SAND, Wet	SP			
							Gray Sandy, Silty CLAY, Trace Gravel, Hard, Moist.	CL			
S-7	12-14	10/11	1.2'				Gray Silty CLAY, Trace Sand, Trace Gravel, Stiff to Very Stiff, Moist.	CL			
		12/11					Brown Fine SAND, Wet	SP			
S-8	14-16	7/5	1.6'			15	Gray Silty CLAY, Trace Sand, Trace Gravel, Stiff to Very Stiff, Moist.	CL	15		
		7/9									
S-9	16-18	5/8	0.7'		(2.5Y 3/2)		Dark Gray Sandy, Silty CLAY, Trace Gravel, Stiff, Moist.	CL			
		8/1									
S-10	18-20	4/5	1.4'				Gray Silty CLAY, Trace Sand, Trace Gravel, Stiff, Moist.	CL			
		7/9				20			20		
S-11	20-22	4/6	1.5'								
		7/8									
S-12	22-24	4/6	1.3'				Gray Sandy, Silty CLAY, Trace Gravel, Stiff, Moist.	CL			
		4/4									
S-13	24-26	4/7	1.6'			25			25		
		8/7									
					(2.5Y 3/2)		Boring Continued on Page 2.				

COMMENTS:

SAMPLE INTERVAL

 = Split Spoon Soil Sample

BORING LOG: MW-6

PAGE 2 OF 2

PROJECT NAME: Feddeler Landfill
 PROJECT NUMBER: 9563-0030-70
 LOCATION: R & M Enterprises
 18501 Clark Road,
 Lowell, Lake County, Indiana
 DATE: 5/16/96 (Boring) & 5/17/96 (Well)
 LOGGED BY: Steve J. Winters
 WEATHER: Sun, 50-70°

DRILLING COMPANY: Top Flight
 DRILLER: Jeff Copak
 RIG TYPE: Mobile B-61
 DRILLING METHOD: Hollow Stem Auger
 BOREHOLE DIAMETER: 6 1/4"
 GROUND ELEVATION: 693.1'
 DEPTH TO WATER: 12.8'

TOTAL DEPTH: 32'
 WELL DIAMETER: 2" (PVC Riser & Screen)
 TOC ELEVATION: 695.97' Above MSL
 SCREENED INTERVAL: 26-31' (0.01" Slo)
 FILTER PACK INTERVAL: 24-31'
 BENTONITE INTERVAL: 20-24'
 GROUT INTERVAL: 1-20'

SAMPLE DATA						DESCRIPTION OF LITHOLOGY			GRAPHIC DIAGRAMS		
SAMPLE TYPE & NUMBER	SAMPLE DEPTH INTERVAL (FEET)	BLOW COUNTS	RECOVERY	PID (PPM)	OTHER SAMPLE DATA REMARKS (Munsell Color)	DEPTH (FEET)	DESCRIBE THE FOLLOWING: COLOR, GRAIN SIZE, MAJOR & MINOR CONSTITUENTS, STRUCTURES, RELATIVE DENSITY, CONSISTENCY, MOISTURE CONTENT	USCS SYMBOL	SAMPLE INTERVAL	LITHOLOGIC PROFILE	WELL CONSTRUCTION DIAGRAM
							Gray Sandy, Silty CLAY, Trace Gravel, Stiff, Moist.	CL			
S-14	26-28	0/0	1.4'		(2.5Y 5-4/2)		Grayish Brown Fine to Medium SAND, Trace Coarse Sand, Trace Gravel, Medium Dense, Saturated.	SP			
		5/5									
S-15	28-30	9/9	2.0'								
		9/6									
S-16	30-32	6/6	2.0'			30			30		
		7/5			(2.5Y 5-4/2)		Gray Sandy, Silty CLAY, Trace Sand, Trace Gravel, Stiff, Moist.	CL			
							End of Boring at 32'.				
						35			35		
						40			40		
						45			45		
						50			50		

COMMENTS:

SAMPLE INTERVAL

 = Split Spoon Soil Sample

Appendix C

In-Situ Clay Material Evaluation

Appendix C

In-Situ Clay Material Evaluation C.1 Permeability Test

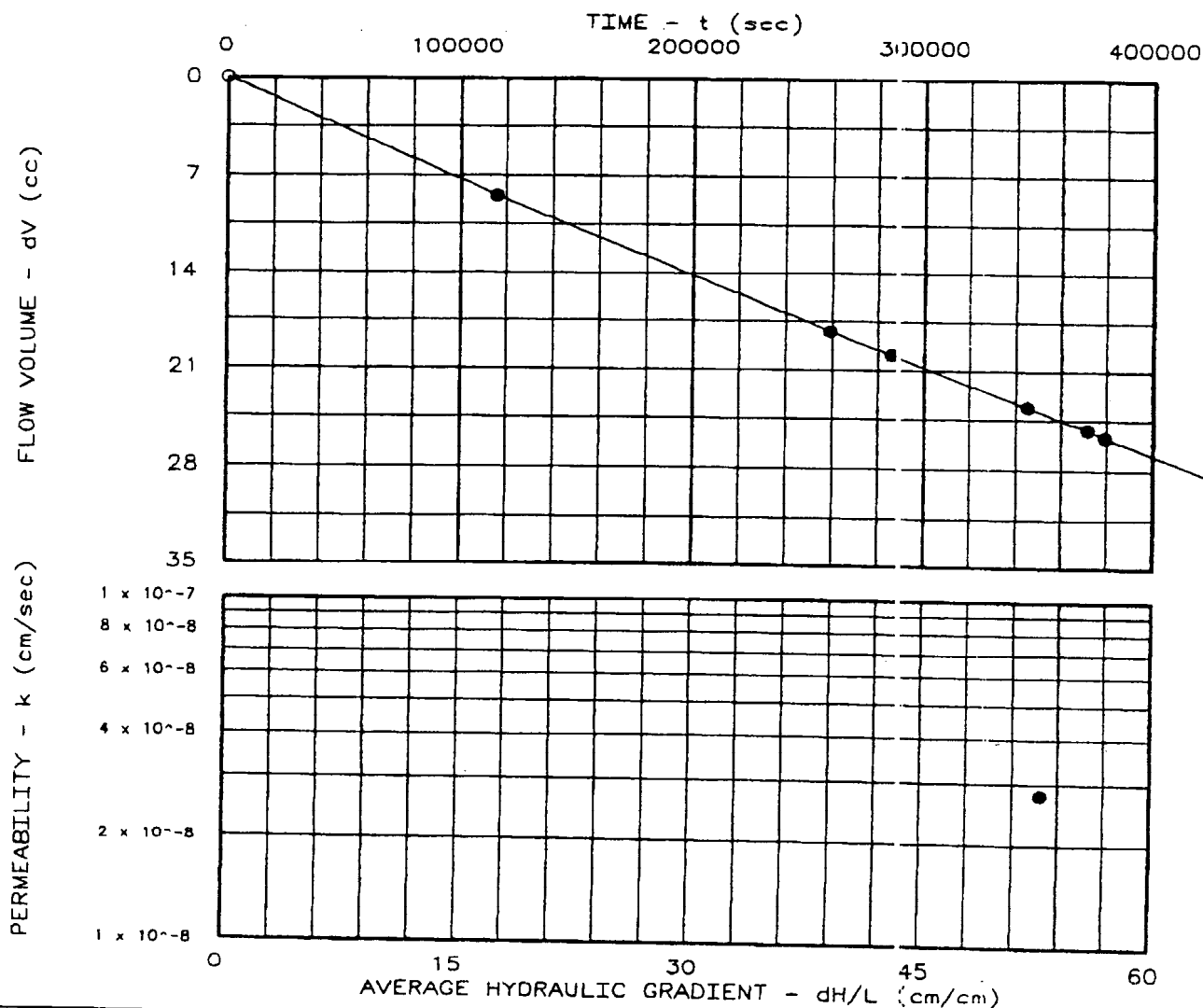
PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.24
 Specimen Diameter (cm): 7.29
 Dry Unit Weight (pcf): 0.0
 Moisture Before Test (%): 0.0
 Moisture After Test (%): 0.0
 Run Number: 1 ● 2 ▲
 Cell Pressure (psi): 25.0
 Test Pressure (psi): 20.0
 Back Pressure (psi): 14.6
 Diff. Head (psi): 5.4
 Flow Rate (cc/sec): 6.40×10^{-5}
 Perm. (cm/sec): 2.77×10^{-8}

SAMPLE DATA:

Sample Identification: SAMPLE: ST-1
 DEPTH: -3.0 BORING: 3505N, 50330E
 Visual Description: BRN. TR GRAY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/3
 Remarks: ELEV 680.32
 Maximum Dry Density (pcf):
 Optimum Moisture Content (%):
 Percent Compaction:
 Permeameter type: FLEXIBLE WALL
 Sample type: SHELBY TUBE



Project: FEDDELER C/D LANDFILL - WEST CELL
 Location: LOWELL, INDIANA
 Date: 5-28-98

Project No.: 0072-03-10
 File No.: 0072-03-10
 Lab No.: 1
 Tested by: JWM
 Checked by: WSG
 Test: CH - Constant head

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: FEDDELER C/D LANDFILL - WEST CELI
 File No.: 0072-03-10
 Project Location: LOWELL, INDIANA
 Project No.: 0072-03-10
 Sample Identification: SAMPLE: ST-1
 Lab No.: DEPTH: -3.0 BORING: 3505N, 50330E
 Description: 1
 BRN, TR GRAY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/3
 Sample Type: SHELBY TUBE
 Max. Dry Dens.:
 Method (D1557/D698):
 Opt. Water Content:
 Date: 5-28-98
 Remarks: ELEV 680.32

Permeameter Type: FLEXIBLE WALL
 Tested by: JWM
 Checked by: WSG
 Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

Before test:

After test:

Before test:			After test:		
Diameter:	1	2	1	2	
Top:	in	in	in	in	
Middle:	2.870 in	in	in	in	
Bottom:	in	in	in	in	
Average:	2.87 in	7.29 cm	0.00 in	0.00 cm	
Length:	1	2	1	2	3
	2.850 in	in	in	in	in
Average:	2.85 in	7.24 cm	0.00 in	0.00 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.75	
Wet Wt. & Tare:	689.60	0.00
Dry Wt. & Tare:	0.00	0.00
Tare Wt.:	0.00	0.00
Moisture Content:	0.0 %	0.0 %
Dry Unit Weight:	0.0 pcf	0.0 pcf
Porosity:	0.0000	0.0000
Saturation:	0.0 %	0.0 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1

Panel No.:

Positions:

Run Number:

1

2

Cell Pressure: 25.0 psi

0.0 psi

Saturation Pressure: 25.0 psi

0.0 psi

Inflow Corr. Factor: 1.00

1.00

Outflow Corr. Factor: 1.00

1.00

Test Temperature: 22.0 °C

0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R S X	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi		BURET READING-cc		FLOW VOLUME-cc AVERAGE
				IN	OUT	IN	OUT	
S X	5/29/98	7:45:00	0	20.0	15.0	9.40	83.00	0.00
	5/30/98	15:55:00	115,800	20.0	15.0	18.30	75.00	8.45
	6/ 1/98	7:42:00	259,020	20.0	15.0	28.40	65.60	18.20
	6/ 1/98	15:07:00	285,720	20.0	15.0	30.20	64.00	19.90
	6/ 2/98	7:34:00	344,940	20.0	15.0	34.00	60.40	23.60
	6/ 2/98	14:57:00	371,520	20.0	15.0	35.60	58.80	25.20
	6/ 2/98	17:05:00	379,200	20.0	15.0	36.10	58.30	25.70
	6/ 3/98	7:29:00	431,040	20.0	15.0	39.40	55.30	28.85
	6/ 3/98	10:57:00	443,520	20.0	15.0	40.20	54.60	29.60
	6/ 3/98	13:28:00	452,580	20.0	15.0	40.80	54.00	30.20

Test Pressure = 20.0 psi Differential Head = 5.4 psi, 382.2 cm H₂O
 Gradient = 5.280E 01 Flow rate = 6.405E-05 cc/sec R squared = 0.99918
 Permeability, K_{22.0°} = 2.906E-08 cm/sec, K_{20°} = 2.770E-08 cm/sec

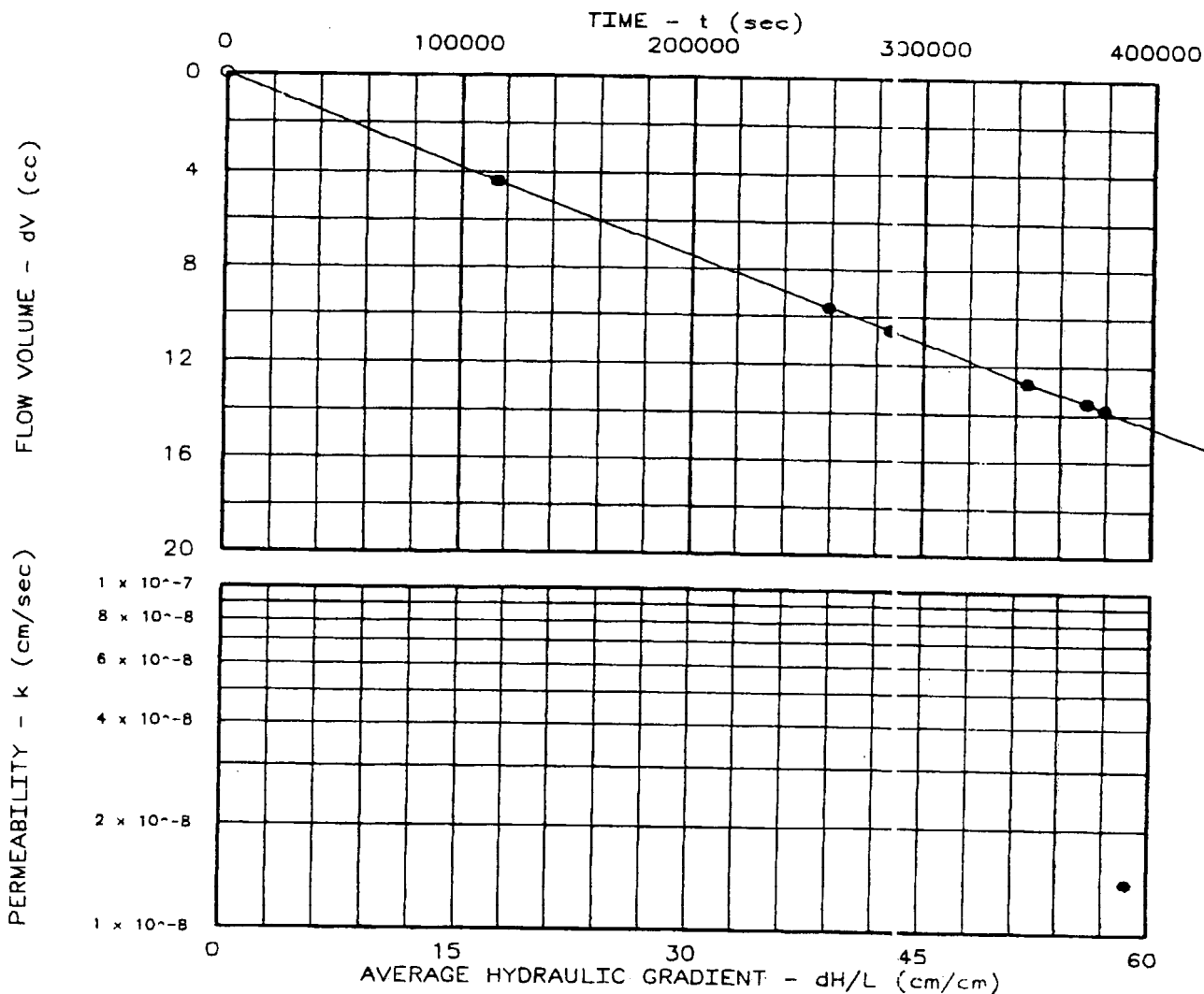
PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.05
 Specimen Diameter (cm): 7.23
 Dry Unit Weight (pcf): 0.0
 Moisture Before Test (%): 0.0
 Moisture After Test (%): 0.0
 Run Number: 1 ● 2 ▲
 Cell Pressure (psi): 25.0
 Test Pressure (psi): 20.0
 Back Pressure (psi): 14.1
 Diff. Head (psi): 5.9
 Flow Rate (cc/sec): 3.55×10^{-5}
 Perm. (cm/sec): 1.41×10^{-8}

SAMPLE DATA:

Sample Identification: SAMPLE: ST-2
 DEPTH: -3.0 BORING: 3510N, 50465E
 Visual Description: BRN/GRY SANDY CLAY LOAM
 MUNSSELL COLOR 2.5 Y 4/2
 Remarks: ELEV 680.79
 Maximum Dry Density (pcf):
 Optimum Moisture Content (%):
 Percent Compaction:
 Permeameter type: FLEXIBLE WALL
 Sample type: SHELBY TUBE



Project: FEDDELER C/D LANDFILL - WEST CELL
 Location: LOWELL, INDIANA
 Date: 5-28-98

Project No.: 0072-03-10
 File No.: 0072-03-10
 Lab No.: 2
 Tested by: JWM
 Checked by: WSG
 Test: CH - Constant head

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: FEDDELER C/D LANDFILL - WEST CELL
 File No.: 0072-03-10
 Project Location: LOWELL, INDIANA
 Project No.: 0072-03-10
 Sample Identification: SAMPLE: ST-2
 DEPTH: -3.0 BORING: 3510N, 50465E
 Lab No.: 2
 Description: BRN/GRY SANDY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/2
 Sample Type: SHELBY TUBE
 Max. Dry Dens.:
 Method (D1557/D698):
 Pot. Water Content:
 Date: 5-28-98
 Remarks: ELEV 680.79
 Permeameter Type: FLEXIBLE WALL
 Tested by: JWM
 Checked by: WSG
 Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

Before test:

After test:

	1	2		1	2	
Diameter:						
Top:	in	in		in	in	
Middle:	2.847 in	in		in	in	
Bottom:	in	in		in	in	
Average:	2.85 in	7.23 cm		0.00 in	0.00 cm	
Length:	1	2	3	1	2	3
	2.775 in	in	in	in	in	in
Average:	2.78 in	7.05 cm		0.00 in	0.00 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.75	
Wet Wt. & Tare:	678.10	0.00
Dry Wt. & Tare:	0.00	0.00
Tare Wt.:	0.00	0.00
Moisture Content:	0.0 %	0.0 %
Dry Unit Weight:	0.0 pcf	0.0 pcf
Porosity:	0.0000	0.0000
Saturation:	0.0 %	0.0 %

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 2

Panel No.:

Positions:

Run Number:

1

2

Cell Pressure:	25.0 psi	0.0 psi
Saturation Pressure:	25.0 psi	0.0 psi
Inflow Corr. Factor:	1.00	1.00
Outflow Corr. Factor:	1.00	1.00
Test Temperature:	22.0 °C	0.0 °C

PERMEABILITY TEST READINGS DATA

CASE	DATE	TIME (24 hr)	ELAPSED TIME-sec	Gauge PRESSURE-psi IN OUT	BUREAU READING-cc IN OUT	FLOW VOLUME-cc AVERAGE
D X						
S R						
S X	5/29/98	7:45:00	0	20.0 15.0	4.60 83.40	0.00
	5/30/98	15:55:00	115,800	20.0 15.0	9.20 79.20	4.40
	6/ 1/98	7:42:00	259,020	20.0 15.0	14.70 74.20	9.65
	6/ 1/98	15:07:00	285,720	20.0 15.0	15.60 73.30	10.55
	6/ 2/98	7:34:00	344,940	20.0 15.0	17.80 71.20	12.70
	6/ 2/98	14:57:00	371,520	20.0 15.0	18.60 70.40	13.50
	6/ 2/98	17:05:00	379,200	20.0 15.0	18.90 70.10	13.80
	6/ 3/98	7:29:00	431,040	20.0 15.0	20.80 68.30	15.65
	6/ 3/98	10:57:00	443,520	20.0 15.0	21.20 67.90	16.05
	6/ 3/98	13:28:00	452,580	20.0 15.0	21.60 67.50	16.45

Test Pressure = 20.0 psi Differential Head = 5.9 psi, 412.6 cm H2O
Gradient = 5.854E 01 Flow rate = 3.549E-05 cc/sec R squared = 0.99973
Permeability, K22.0° = 1.476E-08 cm/sec, K20° = 1.407E-08 cm/sec

Appendix C

In-Situ Clay Material Evaluation C.2 Grain Size Distribution Test

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 5

Date: 6-3-98
Project No.: 0072-03-10
Project: FEDDELER C/D LANDFILL - WEST CELL

Sample Data

Location of Sample: LOWELL, INDIANA
Sample Description: BRN, TR GRAY CLAY LOAM MUNSSELL COLOR 2.5Y 4/3
USCS Class: CL Liquid limit: NA
ASTM Class: A-4 Plasticity index: NA

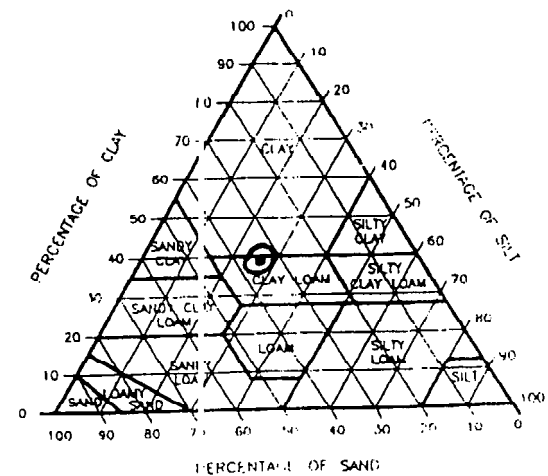
Notes

Remarks: SAMPLE: ST-1 DEPTH: -3.0' (680.32)

Fig. No.:

Mechanical Analysis Data

	Initial	
Dry sample and tare=	375.70	
Tare =	0.00	
Dry sample weight =	375.70	
Sample split on number 10 sieve		
Split sample data:		
Sample and tare = 50	Tare = 0	Sample weight = 50
Cumulative weight retained tare=	0	
Tare for cumulative weight retained=	0	
Sieve	Cumul. Wt. retained	Percent finer
0.5 inches	0.00	100.0
0.375 inches	1.70	99.5
# 4	7.60	98.0
# 10	15.40	95.9
# 20	1.90	92.3
# 35	2.80	90.5
# 40	3.20	89.8
# 60	7.30	81.9
# 100	11.70	73.5
# 140	13.40	70.2
# 200	14.30	68.5
# 270	15.60	66.0



Hydrometer Analysis Data

Separation sieve is number 10
 Percent -# 10 based on complete sample= 95.9
 Weight of hydrometer sample: 50
 Calculated biased weight= 52.14
 Automatic temperature correction
 Composite correction at 20 deg C = -4

Meniscus correction only= 1
 Specific gravity of solids= 2.75
 Specific gravity correction factor= 0.978
 Hydrometer type: 152H Effective depth $L = 16.294964 - 0.164 \times R_m$

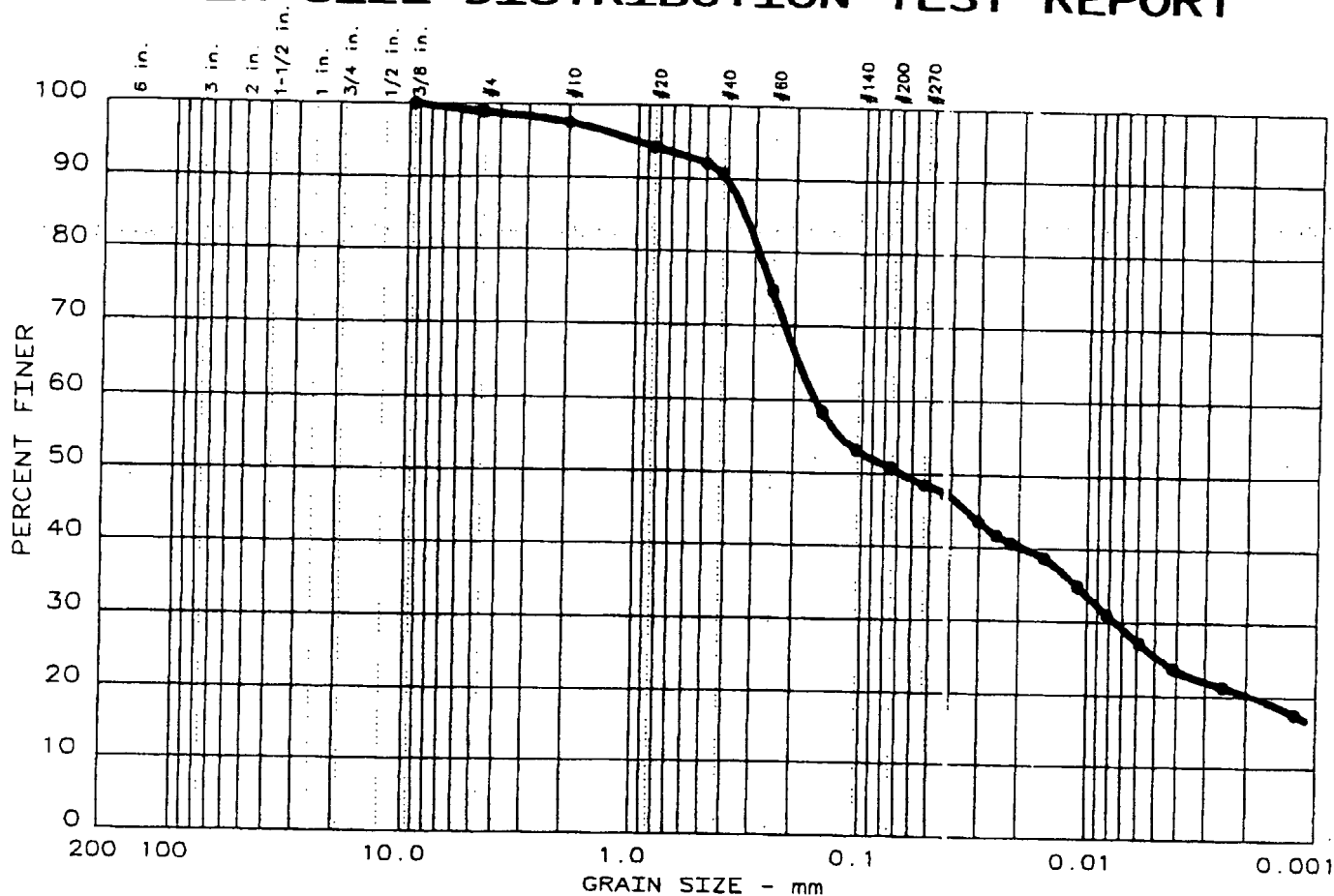
Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	25.0	35.5	32.8	0.0125	36.5	10.3	0.0400	61.5
2.0	25.0	34.0	31.3	0.0125	35.0	10.6	0.0287	58.7
3.0	25.0	33.0	30.3	0.0125	34.0	10.7	0.0236	56.8
4.0	25.0	32.0	29.3	0.0125	33.0	10.9	0.0206	54.9
8.0	25.0	31.0	28.3	0.0125	32.0	11.0	0.0147	53.1
16.0	25.0	29.5	26.8	0.0125	30.5	11.3	0.0105	50.2
30.0	25.0	27.5	24.8	0.0125	28.5	11.6	0.0078	46.5
60.0	25.0	25.0	22.3	0.0125	26.0	12.0	0.0056	41.8
125.0	24.0	22.0	19.0	0.0126	23.0	12.5	0.0040	35.6
330.0	26.0	18.5	16.1	0.0123	19.5	13.1	0.0025	30.3
1410.0	26.0	16.0	13.6	0.0123	17.0	13.5	0.0012	25.6
2850.0	24.0	15.0	12.0	0.0126	16.0	13.7	0.0009	22.4

Fractional Components

Gravel/Sand based on #10 sieve
 Sand/Fines based on #270 sieve
 % + 3 in. = 0.0 % GRAVEL = 4.1 % SAND = 29.9
 % SILT = 26.2 % CLAY = 39.8 (% CLAY COLLOIDS = 23.8)

D85= 0.30 D60= 0.034 D50= 0.010
 D30= 0.0023

GRAIN SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
• 6	0.0	2.4	49.2	22.9	25.5

LL	PI	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
• NA	NA	0.331	0.160	0.0668	0.0075				

MATERIAL DESCRIPTION	USCS	AASHTO
• BRN & GRAY SANDY CLAY LOAM MUNS COLOR 2.5Y 4/2	CL	A-4

Project No.: 0072-03-10

Project: FEDDELER C/D LANDFILL - WEST CELL

• Location: LOWELL, INDIANA

Date: 6-3-98

GRAIN SIZE DISTRIBUTION TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Remarks:

SAMPLE: ST-2

DEPTH: -3.0' (680.79)

Figure No. _____

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 6

Date: 6-3-98

Project No.: 0072-03-10

Project: FEDDELER C/D LANDFILL - WEST CELL

Sample Data

Location of Sample: LOWELL, INDIANA

Sample Description: BRN & GRAY SANDY CLAY LOAM MUNS COLOR 2.5Y 4/2

USCS Class: CL

Liquid limit: NA

ASHTO Class: A-4

Plasticity index: NA

Notes

Remarks: SAMPLE: ST-2 DEPTH: -3.0' (680.79)

Fig. No.:

Mechanical Analysis Data

Initial

Dry sample and tare= 382.80

Tare = 0.00

Dry sample weight = 382.80

Sample split on number 10 sieve

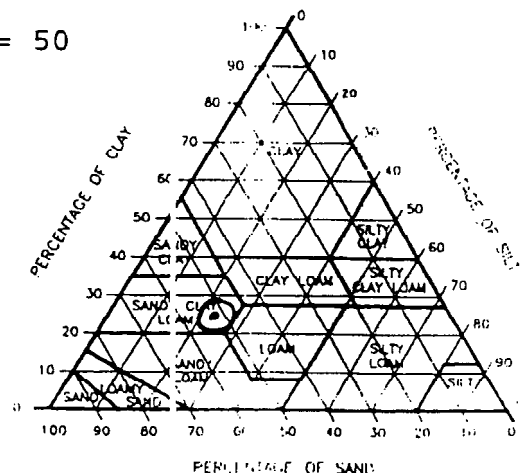
Split sample data:

Sample and tare = 50 Tare = 0 Sample weight = 50

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
0.375 inches	0.00	100.0
# 4	4.10	98.9
# 10	9.30	97.6
# 20	1.70	94.3
# 35	2.80	92.1
# 40	3.50	90.7
# 60	11.70	74.7
# 100	20.10	58.3
# 140	22.80	53.1
# 200	24.00	50.7
# 270	25.20	48.4



Hydrometer Analysis Data

Separation sieve is number 10

Percent -# 10 based on complete sample= 97.6

Weight of hydrometer sample: 50

Calculated biased weight= 51.24

Automatic temperature correction

Meniscus correction only= 1

Specific gravity of solids= 2.75

Specific gravity correction factor= 0.978

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
1.0	25.0	27.5	24.8	0.0125	28.5	11.6	0.0425	47.3
2.0	25.0	25.5	22.8	0.0125	26.5	11.9	0.0305	43.5
3.0	25.0	24.5	21.8	0.0125	25.5	12.1	0.0251	41.6
4.0	25.0	24.0	21.3	0.0125	25.0	12.2	0.0218	40.6
8.0	25.0	23.0	20.3	0.0125	24.0	12.4	0.0155	38.7
16.0	25.0	21.0	18.3	0.0125	22.0	12.7	0.0111	34.9
30.0	25.0	19.0	16.3	0.0125	20.0	13.0	0.0082	31.1
60.0	25.0	17.0	14.3	0.0125	18.0	13.3	0.0059	27.3
125.0	24.0	15.5	12.5	0.0126	16.5	13.6	0.0042	23.8
330.0	26.0	13.5	11.1	0.0123	14.5	13.9	0.0025	21.3
1410.0	26.0	11.5	9.1	0.0123	12.5	14.2	0.0012	17.5
2850.0	24.0	11.0	8.0	0.0126	12.0	14.3	0.0009	15.2

Fractional Components

Gravel/Sand based on #10 sieve

Sand/Fines based on #270 sieve

+ 3 in. = 0.0 % GRAVEL = 2.4 % SAND = 49.2
% SILT = 22.9 % CLAY = 25.5 (% CLAY COLLOIDS = 16.0)W₈₅= 0.33 D₆₀= 0.160 D₅₀= 0.067D₃₀= 0.0075

Appendix D
West Cell Survey Data

CONSTRUCTION SURVEY DATA

FEDDELER C/D LANDFILL

STATE ROAD 2

LOWELL, INDIANA

West Cell Floor Elevations

North	East	Cell Floor elevation
2203358.57	2850499.10	682.52
2203361.85	2850451.89	681.85
2203369.96	2850394.77	681.42
2203368.59	2850344.54	681.58
2203407.43	2850298.27	681.02
2203444.68	2850303.32	680.71
2203447.33	2850277.90	680.62
2203439.99	2850357.04	680.77
2203447.87	2850416.80	680.65
2203443.09	2850464.76	680.61
2203442.54	2850522.35	681.03
2203485.47	2850489.28	680.77
2203491.74	2850435.91	681.13
2203491.66	2850380.32	681.05
2203494.48	2850333.56	680.42
2203505.98	2850284.26	681.09

Weaver Boos Consultants, Inc.

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604 • 312/922-1030 FAX 922-0201

Project No.: _____

FAX COVER SHEET

To: To Whom it May Concern

From: Peter Lambouris

Company: IDEM

Date: _____

Fax: 317-237-3403

Pages including cover sheet: 7

Regarding: Feddeler C/D Landfill West Cell

MESSAGE:

To whom it May Concern:

The Feddeler C/D Landfill West Cell Construction Completion Report was sent to your attention on June 3, 1998 via UPS. In the text we stated the permeability test results for soil were preliminary and the final results will be faxed to you upon their completion. Therefore, the following are the final soil permeability test results for ST-1 and ST-2.

If you have any questions please do not hesitate to call.

Signed: Peter Lambouris

Hard Copy transmitted via: Regular Mail Express Mail No Hard Copy

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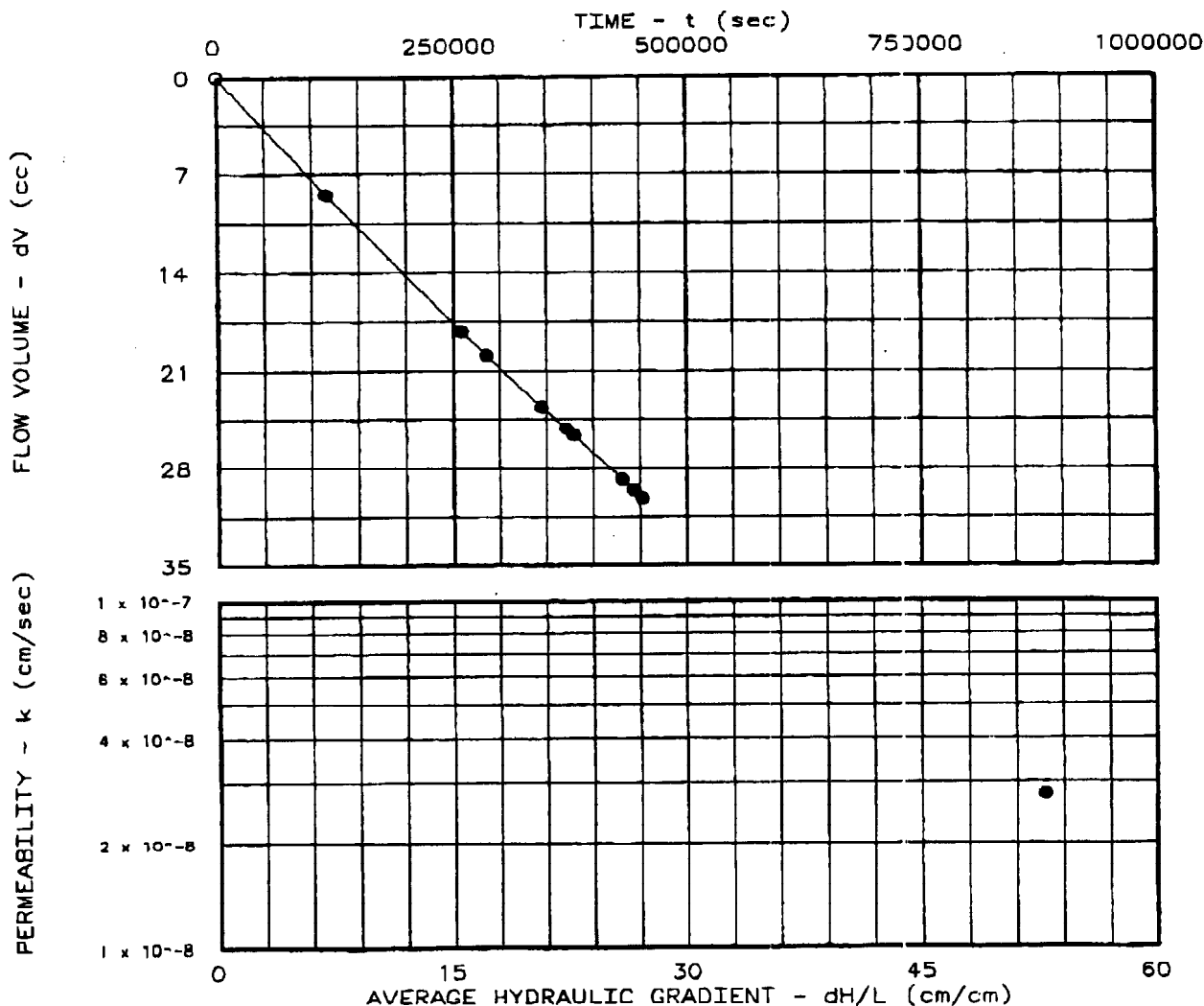
PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.24
 Specimen Diameter (cm): 7.29
 Dry Unit Weight (pcf): 129.0
 Moisture Before Test (%): 10.4
 Moisture After Test (%): 11.5
 Run Number: 1 • 2 ▲
 Cell Pressure (psi): 25.0
 Test Pressure (psi): 20.0
 Back Pressure (psi): 14.6
 Diff. Head (psi): 5.4
 Flow Rate (cc/sec): 5.40×10^{-5}
 Perm. (cm/sec): 2.77×10^{-8}

SAMPLE DATA:

Sample Identification: SAMPLE: ST-1
 DEPTH: -3.0 BORING: 3505N, 50330E
 Visual Description: BRN. TR GRAY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/3
 Remarks: ELEV 680.32
 Maximum Dry Density (pcf):
 Optimum Moisture Content (%):
 Percent Compaction:
 Permeameter type: FLEXIBLE WALL
 Sample type: SHELBY TUBE



Project: FEDDELER C/D LANDFILL - WEST CELL
 Location: LOWELL, INDIANA
 Date: 5-28-98

Project No.: 0072-03-10
 File No.: 0072-03-10
 Lab No.: 1

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Tested by: JWM
 Checked by: WSG
 Test: CH - Constant head

Jun-04-98 04:10P Weaver Boos Griffith

219-923-9641

.P.09

PERMEABILITY TEST DATA

PROJECT DATA

Project Name: FEDDELER C/D LANDFILL - WEST CELL
 File No.: 0072-03-10
 Project Location: LOWELL, INDIANA
 Project No.: 0072-03-10
 Sample Identification: SAMPLE: ST-1
 DEPTH: -3.0 BORING: 3505N, 50330E
 Lab No.: 1
 Description: BRN, TR GRAY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/3
 Sample Type: SHELBY TUBE
 Max. Dry Dens.:
 Method (D1557/D698):
 Opt. Water Content:
 Date: 5-28-98
 Remarks: ELEV 680.32
 Permeameter Type: FLEXIBLE WALL
 Tested by: JWM
 Checked by: WSG
 Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:	in	in		in	in	
Middle:	2.870 in	in		2.867 in	in	
Bottom:	in	in		in	in	
Average:	2.87 in	7.29 cm		2.87 in	7.28 cm	
Length:	1	2	3	1	2	3
	2.850 in	in	in	2.847 in	in	in
Average:	2.85 in	7.24 cm		2.85 in	7.23 cm	

Moisture, Density and Sample Parameters:

Specific Gravity:	2.75	
Wet Wt. & Tare:	689.60	696.30
Dry Wt. & Tare:	624.40	624.40
Tare Wt.:	0.00	0.00
Moisture Content:	10.4 %	11.5 %
Dry Unit Weight:	129.0 pcf	129.4 pcf
Porosity:	0.2485	0.2461
Saturation:	86.8 %	97.0 %

JUN-04-98 04:10P Weaver Boos Griffith 219-923-9641

P.10

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 1

Panel No.:

Positions:

Run Number:

1

2

Cell Pressure: 25.0 psi

0.0 psi

Saturation Pressure: 25.0 psi

0.0 psi

Inflow Corr. Factor: 1.00

1.00

Outflow Corr. Factor: 1.00

1.00

Test Temperature: 22.0 °C

0.0 °C

PERMEABILITY TEST READINGS DATA

CASE	DATE	TIME	ELAPSED	GAUGE		BURET		FLOW
D X		(24 hr)	TIME-sec	PRESSURE-psi		READING-cc		VOLUME-cc
S R				IN OUT		IN OUT		AVERAGE
S X	5/29/98	7:45:00	0	20.0 15.0		9.40 83.00		0.00
	5/30/98	15:55:00	115,800	20.0 15.0		18.30 75.00		8.45
	6/ 1/98	7:42:00	259,020	20.0 15.0		28.40 65.60		18.20
	6/ 1/98	15:07:00	285,720	20.0 15.0		30.20 64.00		19.90
	6/ 2/98	7:34:00	344,940	20.0 15.0		34.00 60.40		23.60
	6/ 2/98	14:57:00	371,520	20.0 15.0		35.60 58.80		25.20
	6/ 2/98	17:05:00	379,200	20.0 15.0		36.10 58.30		25.70
	6/ 3/98	7:29:00	431,040	20.0 15.0		39.40 55.30		28.85
	6/ 3/98	10:57:00	443,520	20.0 15.0		40.20 54.60		29.60
	6/ 3/98	13:28:00	452,580	20.0 15.0		40.80 54.00		30.20

Test Pressure = 20.0 psi Differential Head = 5.4 psi, 382.2 cm H2O
 Gradient = 5.280E 01 Flow rate = 6.405E-05 cc/sec R squared = 0.99918
 Permeability, K22.0° = 2.906E-08 cm/sec, K20° = 2.770E-08 cm/sec

PAGE 2

WEAVER BOOS CONSULTANTS, INC.

DATA SET 3

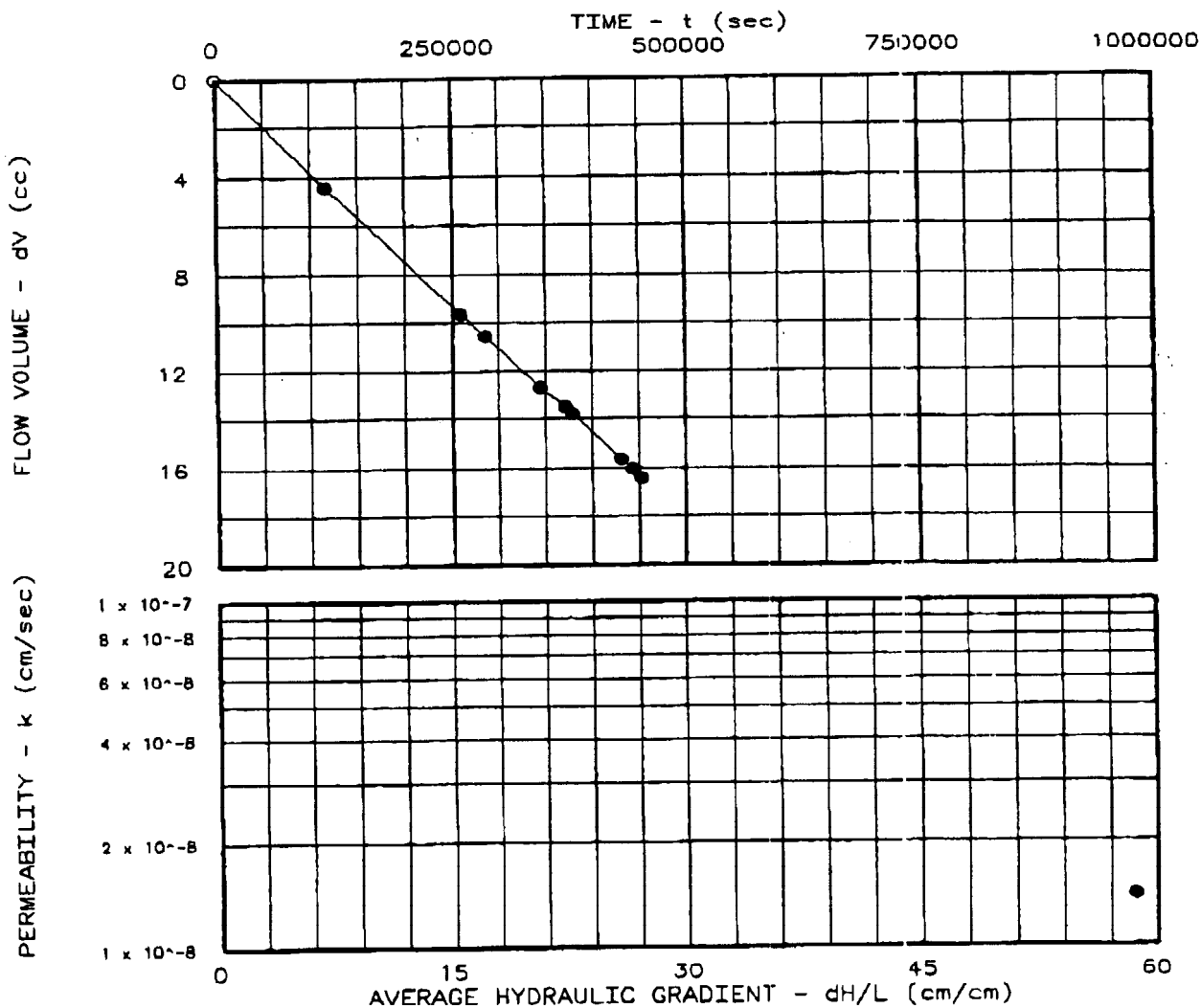
PERMEABILITY TEST REPORT

TEST DATA:

Specimen Height (cm): 7.05
 Specimen Diameter (cm): 7.23
 Dry Unit Weight (pcf): 132.4
 Moisture Before Test (%): 10.5
 Moisture After Test (%): 11.2
 Run Number: 1 • 2 ▲
 Cell Pressure (psi): 25.0
 Test Pressure (psi): 20.0
 Back Pressure (psi): 14.1
 Diff. Head (psi): 5.9
 Flow Rate (cc/sec): 3.55×10^{-5}
 Perm. (cm/sec): 1.41×10^{-8}

SAMPLE DATA:

Sample Identification: SAMPLE: ST-2
 DEPTH: -3.0 BORING: 3510N, 50465E
 Visual Description: BRN/GRY SANDY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/2
 Remarks: ELEV 680.79
 Maximum Dry Density (pcf):
 Optimum Moisture Content (%):
 Percent Compaction:
 Permeameter type: FLEXIBLE WALL
 Sample type: SHELBY TUBE



Project: FEDDELER C/D LANDFILL - WEST CELL
 Location: LOWELL, INDIANA
 Date: 5-28-98

PERMEABILITY TEST REPORT

WEAVER BOOS CONSULTANTS, INC.

Project No.: 0072-03-10
 File No.: 0072-03-10
 Lab No.: 2

Tested by: JWM
 Checked by: WSG
 Test: CH - Constant head

JUN-04-98 04:11P Weaver Boos Griffith 219-923-9641

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PERMEABILITY TEST DATA

PROJECT DATA

Project Name: FEDDELER C/D LANDFILL - WEST CELL
 File No.: 0072-03-10
 Project Location: LOWELL, INDIANA
 Project No.: 0072-03-10
 Sample Identification: SAMPLE: ST-2
 DEPTH: -3.0 BORING: 3510N, 50465E
 Lab No.: 2
 Description: BRN/GRY SANDY CLAY LOAM
 MUNSELL COLOR 2.5 Y 4/2
 Sample Type: SHELBY TUBE
 Max. Dry Dens.:
 Method (D1557/D698):
 Opt. Water Content:
 Date: 5-28-98
 Remarks: ELEV 680.79
 Permeameter Type: FLEXIBLE WALL
 Tested by: JWM
 Checked by: WSG
 Test type: CH - Constant head

PERMEABILITY TEST SPECIMEN DATA

	Before test:			After test:		
Diameter:	1	2		1	2	
Top:		in			in	
Middle:	2.847	in		2.878	in	
Bottom:		in			in	
Average:	2.85	in	7.23 cm	2.88	in	7.31 cm
Length:	1	2	3	1	2	3
	2.775	in	in	2.751	in	in
Average:	2.78	in	7.05 cm	2.75	in	6.99 cm
Moisture, Density and Sample Parameters:						
Specific Gravity:	2.75					
Wet Wt. & Tare:	678.10			682.50		
Dry Wt. & Tare:	613.90			613.90		
Tare Wt.:	0.00			0.00		
Moisture Content:	10.5 %			11.2 %		
Dry Unit Weight:	132.4 pcf			130.7 pcf		
Porosity:	0.2289			0.2388		
Saturation:	96.9 %			98.0 %		

PAGE 1

WEAVER BOOS CONSULTANTS, INC.

DATA SET 4

Jun-04-98 04:11P Weaver Boos Griffith 219-923-9641

P.13

CONSTANT HEAD PERMEABILITY TEST CONDITIONS DATA

Cell No.: 2

Panel No.:

Positions:

Run Number:

1

2

Cell Pressure: 25.0 psi

0.0 psi

Saturation Pressure: 25.0 psi

0.0 psi

Inflow Corr. Factor: 1.00

1.00

Outflow Corr. Factor: 1.00

1.00

Test Temperature: 22.0 °C

0.0 °C

PERMEABILITY TEST READINGS DATA

CASE D X S R	DATE	TIME (24 hr)	ELAPSED TIME-sec	GAUGE PRESSURE-psi		BURET READING-cc		FLOW VOLUME-cc AVERAGE
				IN	OUT	IN	OUT	
S X	5/29/98	7:45:00	0	20.0	15.0	4.60	83.40	0.00
	5/30/98	15:55:00	115,800	20.0	15.0	9.20	79.20	4.40
	6/ 1/98	7:42:00	259,020	20.0	15.0	14.70	74.20	9.65
	6/ 1/98	15:07:00	285,720	20.0	15.0	15.60	73.30	10.55
	6/ 2/98	7:34:00	344,940	20.0	15.0	17.80	71.20	12.70
	6/ 2/98	14:57:00	371,520	20.0	15.0	18.60	70.40	13.50
	6/ 2/98	17:05:00	379,200	20.0	15.0	18.90	70.10	13.80
	6/ 3/98	7:29:00	431,040	20.0	15.0	20.80	68.30	15.65
	6/ 3/98	10:57:00	443,520	20.0	15.0	21.20	67.90	16.05
	6/ 3/98	13:28:00	452,580	20.0	15.0	21.60	67.50	16.45

Test Pressure = 20.0 psi Differential Head = 5.9 psi, 412.6 cm H2O
 Gradient = 5.854E 01 Flow rate = 3.549E-05 cc/sec R squared = 0.99973
 Permeability, K22.0° = 1.476E-08 cm/sec, K20° = 1.407E-08 cm/sec

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PAGE 2 WEAVER BOOS CONSULTANTS, INC.

DATA SET 4

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May 18, 1998
File 97694.02

2C6a
Feddeler Co Site
Lake Co

**FEDDELER C&D LANDFILL
NORTH FACILITY EAST CELL
CLAY LINER CONSTRUCTION**

**R&M Enterprises, Inc.
Lowell, Indiana**

Permit #IND FP # 45-08

Winter/Spring 1998

Prepared For:
R&M Enterprises, Inc.
18501 Clark Road
Lowell, Indiana 46356

*Weaver
Boos
Consultants, Inc.*

ENVIRONMENTAL AND GEOTECHNICAL SERVICES
Chicago, Illinois Griffith, Indiana Albuquerque, New Mexico

*Weaver
Boos
Consultants, Inc.*

200 SOUTH MICHIGAN AVENUE • CHICAGO, ILLINOIS 60604 • 312/922-1030 FAX 922-0201

May 18, 1998
Project # 97094.02

Ms. Daniela Klesmith
Solid Waste Facilities Branch
Office of Solid and Hazardous Waste Management
Indiana Department of Environmental Management
100 North Senate Avenue
P.O. Box 6015
Indianapolis, Indiana 46206-6015

DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
HAZARDOUS WASTE MANAGEMENT

MAY 19 1998

RECEIVED

**Re: Feddeler/C/D Landfill
Construction Completion Report for
Construction of Clay Liner for East Cell**

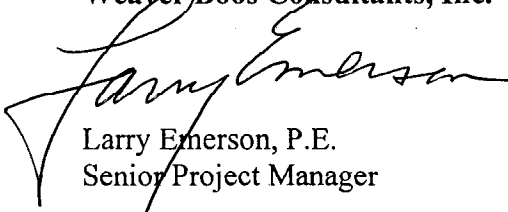
Dear Ms. Klesmith:

As a follow up to our meeting on May 14, 1998, I am sending herewith two copies of the referenced construction completion report.

I hereby certify that to the best of my knowledge, the North Facility East Cell Clay Liner has been constructed in accordance with the applicable permit documents and regulatory requirements. This certification is based upon construction observation conducted by properly trained and experienced persons working under my direct supervision.

If you have any questions or require additional information, please call me.

Sincerely,
Weaver Boos Consultants, Inc.


Larry Emerson, P.E.
Senior Project Manager

cc: Ms. Julie Feddeler (R & M Enterprises)

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Table 2	Construction Survey Data

DEPARTMENT OF
ENVIRONMENTAL MANAGEMENT
SOLID & HAZARDOUS WASTE MANAGEMENT

MAY 19 1998

LIST OF FIGURES

Figure 1	As-Built Top of Clay Liner
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RECEIVED

FIELD LOG AND PHOTOGRAPHS

Photographic Log
Daily Summary Reports

LIST OF APPENDICES

Appendix A Clay Liner Construction Quality Evaluation Testing

- A.1 Soil Evaluation Log
- A.2 Liquid and Plastic Limits Test
- A.3 Grain Size Distribution Test
- A.4 Moisture-Density Relativity Test
- A.5 Permeability Test

Appendix B Field Compaction Test

- B.1 Field Moisture/Density Testing

Appendix C East Cell Survey Data

- C.1. Clay Liner Construction Elevations

1.0 EXECUTIVE SUMMARY

1.1 General

This report assembles the majority of the Construction Observation and Testing documentation performed during the construction of the East Cell clay liner at the Feddeler C/D Landfill. All work was performed in general accordance with the conditions of permit FP # 45-08 issued on August 7, 1981 and modified on June 13, 1995.

A minimum 3-foot thick compacted clay liner was constructed in the East Cell floor located at the north end of the facility. Soils for clay liner were excavated from west of the East Cell. Per permit requirements (Part A1), clay liner material consisted of clayey soils with a hydraulic conductivity value of 1×10^{-6} cm/sec or less. Clay liner soils were placed and compacted in maximum nine (9) inch loose lifts.

The project area was surveyed and benchmarks were established so that locations of sample and testing points could be readily discernible by the Engineering Technician. Temporary benchmarks were used as reference points to verify a minimum 3.0 foot thick clay liner was constructed.

During the construction of the East Cell, Weaver Boos personnel were on-site to make observations, records and inspections of the construction activities. The purpose of this work was to observe that the final constructed product meets with project specifications and regulatory requirements. Technical specifications, visual observations, and tests were used to provide quantitative criteria with which to evaluate the final product.

Photographic logs showing various activities performed throughout the course of the project are shown in *Field Log and Photographs*.

1.2 Report Organization

The remainder of this Construction Completion Report describes the observation and documentation activities and procedures used to confirm that the East Cell was constructed in compliance with the approved construction quality assurance protocol. The attached figures, appendices and photograph log provide appropriate quantitative and qualitative documentation. Cross references to the attachments are highlighted in order to facilitate review.

2.0 CLAY LINER PLACEMENT

2.1 General

At the East Cell of the Feddeler C/D Landfill, compacted clay liner (CCL) was constructed to a minimum of than 3.0 feet in thickness. All clay material was compacted to at least 95-percent of the maximum dry density at a moisture content of zero to five percent above optimum, as determined by Standard Proctor Test (ASTM D 698). Material utilized for clay liner was excavated from an area west of the construction site. Excavated clay liner material was a clayey soil that possessed a hydraulic conductivity value of 10^{-6} cm/sec or less meeting requirements of the permit, Part A4 and Part A1, respectively.

2.2 Compacted Clay Liner Construction

Clay liner material was excavated with a backhoe, transported by a 6x6 off-road truck, placed with two dozers and compacted with a sheepsfoot roller. Due to the nature of subgrade, the initial lift of clay liner material was placed as a one-foot loose lift. This was to avoid mixing of different material during clay liner compaction. Clay liner was placed and compacted in nine (9) inch loose lifts, the initial one (1) foot lift and the additional three (3) nine (9) inch lifts, in order to facilitate the required compaction of clay material. Clay material was compacted to at least 95-percent of the maximum dry density (Standard Proctor) at moisture content of zero to five percent above optimum. Compaction was performed to achieve an equivalent hydraulic conductivity of not more than 1×10^{-6} cm/sec as required in Part A1 of the permit. As previously mentioned, compaction was achieved using a sheepsfoot roller. The sheepsfoot roller not only achieves the minimum compaction, but also binds successive clay lifts. Smooth surfaces between clay lifts were prohibited. Compaction testing on the clay liner was performed by a Weaver Boos representative, with a nuclear moisture/density gauge in accordance with ASTM Standards. The reference Proctor moisture/density relationships are included in *Appendix A*. Field compaction test forms for construction of clay liner are located in *Appendix B*.

Placement of clay was such that the compacted upper surface had sufficient slope to facilitate drainage. Before each day's work was complete, low areas were filled in and sloped to avoid ponding water. Any standing water or soft soil was removed and local depressions were filled prior to placement of additional liner material.

During construction, observation was provided by a Weaver Boos representative along with select soils testing which was performed to confirm suitability of soils used for clay liner. Only soils meeting project specifications, in particular the permeability requirement of $K \leq 1 \times 10^{-6}$

cm/sec, were utilized. Construction of the East Cell 3.0 foot clay liner required the placement, compaction and grading of approximately 5,600 cubic yards of clay material. Completed compacted clay liner was protected from traffic, erosion and damage where possible.

Daily summary reports, which were logged during each construction day, and photographs showing clay liner construction activities within the East Cell boundaries are provided in the *Field Log and Photographs*. Survey data verifying a minimum 3.0 foot thickness of the final prepared compacted clay liner is included in *Appendix C*.

2.3 Clay Liner Construction Quality Evaluation Testing

During clay liner construction, approximately 5,600 cubic yards of clay material was utilized for approximately 1.2 acres. Soil testing for construction quality evaluation was performed based on this volume and area and in general accordance with accepted minimum testing frequencies stipulated in the permit. Numerous construction quality qualification tests of the clay material were performed including two (2) Standard Proctors, 68 moisture contents and two (2) undisturbed laboratory permeability tests. This testing frequency exceeded the minimum requirements for clay material utilized in clay liner construction. Soil testing results indicate that clay material meets various soil parameters. According to the approved permit FP# 45-08, construction quality evaluation testing requirements for the clay construction material are as follows:

CLAY CONSTRUCTION MATERIAL MINIMUM TESTING REQUIREMENTS

Test Method	Minimum Frequency (one test per)	Specification
Moisture Content (ASTM 3017)	5 Tests/Acre/Lift	_____
Moisture-Density Curve (ASTM D1557-91)	5,000 Yd ³	_____
Laboratory Permeability (undisturbed sample)	1 Test/Acre	$K \leq 1 \times 10^{-6} \text{ cm/sec}$

2.3.1 Moisture Content Testing for Construction Quality Evaluation

The minimum testing requirements for moisture content determination, for the purposes of construction material evaluation, are five tests for every acre per lift of clay placed. Therefore, a total minimum of 40 moisture content tests is required. A total number of 68 moisture content tests were performed, evenly distributed between successful clay lifts. Moisture contents test results for construction material evaluation can be found in *Table 1*. Results of moisture content tests revealed that the quality of clay material delivered on-site was consistent.

2.3.2 Moisture-Density Testing for Construction Quality Evaluation

As stipulated in the permit, a minimum of one test per 5,000 cubic yards of clay material placed is required to establish a proctor reference for the construction of the clay liner. Based on the volume of compacted clay liner placed in the East Cell, two (2) Standard Proctor tests were required to be performed on the clay liner material. A total of two (2) tests were performed. Random samples of clay were collected from excavated clay liner material, west of the East Cell. Standard Proctor tests were performed on these excavated soil samples. Proctors performed for construction quality evaluation, along with tests performed on soil samples from the borrow pits, were used to determine required field compaction effort. Compacted clay material maximum dry densities ranged from 117.5 to 120.3 pcf. Optimum moisture contents ranged from 12.2 to 12.4 percent. Test results are included *Table 1*.

2.3.3 Undisturbed Permeability Testing for Construction Quality Evaluation

According to the approved permit, a minimum one (1) test per acre of undisturbed laboratory permeability test is required for construction quality evaluation purposes. Permit specifications require compacted clay liner to possess a hydraulic conductivity value of $K \leq 1 \times 10^{-6}$ cm/sec. Permeability testing was performed on two (2) undisturbed samples obtained from the compacted clay liner by means of a Shelby tube sampler. Samples were isotropically consolidated and backpressure saturated before beginning the permeability testing. The two (2) undisturbed permeability tests yielded hydraulic conductivity values ranging from 2.7×10^{-8} cm/sec to 2.105×10^{-8} cm/sec. Undisturbed permeability test results for construction quality evaluation can be found in *Table 1*.

2.3.4 Field Compaction Testing for Construction Quality Evaluation

Field compaction testing was performed as a part of construction observation of compacted clay liner. Following placement and compaction of each lift nuclear density (ASTM D2922) testing was performed using a field nuclear density gauge. A minimum of one compaction test was performed for every 100 feet by 100 feet square area per for any fill material placed. Placement of approximately 1.2 acres of clay liner material requires a minimum of 40 nuclear density tests be performed. Test results included in *Appendix B* show that a total of 68 density tests was performed. Out of the 68 tests performed, 67 tests met the specification stipulated for density and optimum moisture. At failing locations, subject material was watered and the clay liner material recompacted until specifications for density and optimum moisture were met.

3.0 SURVEYING

3.1 General

Throughout the construction of the East Cell, surveying was performed by a Weaver Boos Representative to maintain compliance with the permit requirements. Surveying for elevation and location was performed. The as built drawing of completed East Cell construction can be found in the *Figures Section*.

The data in *Appendix C* has been copied from field notes which are maintained in the project files at **Weaver Boos Consultants, Inc.**, Chicago, Illinois.

Surveying was performed to show a minimum 3.0 foot thickness of clay liner.

4.0 ENGINEERING CERTIFICATION

CONSTRUCTION COMPLETION REPORT

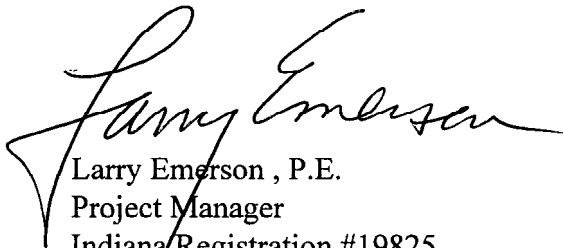
Feddeler North Facility C/D Landfill

East Cell

Lowell, Indiana

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further certify that I am authorized to submit this information.

Very truly yours,
Weaver Boos Consultants, Inc.



Larry Emerson, P.E.
Project Manager
Indiana Registration #19825

